ISSN 0704-3716

Canadian Translation of Fisheries and Aquatic Sciences

No. 5429

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U. Steingrimsdottir

Original title: Nokkur liftaekniverkefni a Rannsoknastofnun fiskionaoarins

In: AEGIR, Journal of the Fisheries Association of Iceland 81(10): 532-534, 1988

Original language: Icelandic

Available from:
Canada Institute for Scientific and Technical Information
National Research Council
Ottawa, Ontario, Canada K1A 0S2

1989

8 typescript pages

90-00619/

Department of the Secretary of State of Canada | Secrétariat d'État du Canada

MULTILINGUAL SERVICES DIVISION – DIVISION DES SERVICES MULTILINGUES

TRANSLATION BUREAU | BUREAU DES TRADUCTIONS

Client's No.–N° du client	Department – Ministère	Division/Branch – Division/Direction	City – Ville
-	DFO	Sci Publications	Ottawa, Ont.
Bureau No.–N° du bureau	**Language – Langue**	**Translator (Initials) – Traducteur (Initiales)**	
3038772	Icelandic	OM	5/1-89

AEGIR. Rit Fiskifelags Islands (AEGIR. Journal of the Fisheries Association of Iceland). Vol. 81, No. 10, October 1988, pp. 532-534. (Iceland).

Bioengineering work in the Icelandic Fisheries Laboratories

by Unnur Steingrimsdottir

1. Introduction

Bioengineering has been discussed and written about a great deal during the last few years, and opinions have always been many. One of the main reasons for these discussions has been the fact that it is becoming increasingly more evident that the resources of nature are not inexhaustible. The future of mankind is dependent on whether we succeed in using natural resources judiciously and fairly. It is imperative that raw material be used as properly as possible, and bioengineering can be useful to us in this respect. This brief article will not constitute any comprehensive survey of the bioengineering work of the laboratory. It will primarily discuss some limited tasks, which are just part of the bioengineering work.

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SEC 5-25 (86-02)

2. Enzymatic removal of the membrane of cod liver

This work was started in mid-1985. The round worm has greatly increased in liver, particularly in liver from open boats, and much of the liver is collected for canning in the winter fishing season. The round worm mostly stays under the membrane on the surface of the liver tissue. It is easy to dispose of the worms if the membrane is removed. No mechanization is suitable and it is not feasible to remove the membrane manually. Liver that has many round worms is therefore sent for processing. The objective was to develop a method to remove the membrane, and enzymes were tried. A total of 20 different enzymes were tested and a suitable method was eventually successfully developed. It was tried a few times in a canning plant. The enzymatically processed liver was canned, taste-tested and various measurements were taken, and the liver was compared to liver that was canned in the customary way at the same time as the enzymatically processed liver. The results unequivocally indicated that enzymes in no way changed the taste quality or the texture of the liver. It also turned out that the output of liver cleaning increased by about 30-40% and canning use was normal. A patent was being secured for the method at the time and it was for that reason not put into use. Time will show whether this will take place. However, it should be pointed out that the round worm is not the main problem in liver canning. The problem that we should tackle originates with man. Fish liver does not have the status that it should have as a raw material in foodstuff production.

Handling of liver leaves much to be desired. Gallbladders floating in collection containers will break in all likelihood and easily ruin 4-5 livers. Entrails are also the cause of much damage as they contain digestive enzyme. It is obvious that half-digested liver should not end up in cans. It should also be pointed out that liver that is meant for canning should not be stored in uncovered containers in open air. Liver tissue is very sensitive. Its enzymatic content is high as many plants know by experience, and its role is highly varied. This should be kept in mind when

533

liver is collected for canning. The following will influence the quality of liver in particular:

1. Gallbladder and entrails. The bile dyes the liver and causes an off-taste, and entrails generate enzymes as indicated above.

2. Pressure. Liver texture is soft. If it is put under a lot of pressure, it begins to generate enzymes and self-digestion starts. It should therefore as a rule not be collected in large containers.

3. Water has a negative effect on fish liver and seems to quicken self-digestion. It is therefore not advisable to store liver meant for canning in water any longer than necessary.

Liver that is collected for canning is most advantageously collected in 25-30 kg plastic bags, which are then well tied and thoroughly iced. Good liver keeps in this manner for 5-6 days. It should be repeated that scooping out the water affects the keeping quality.

3. Enzymatic processing of swimbladders

SIF turned to the Icelandic Fisheries Laboratories last winter and asked it to assist in the removal of the membrane of swimbladders. The price of swimbladders has been favorable. A market for salted swimbladders exists now, and, processed in that manner, it loses a good deal less weight than dried swimbladder. It is necessary to remove the dark membrane from it for it to fetch a good price, but the removal involves a lot of work and it is time-consuming. It was hoped that enzymes could be used for this purpose. The laboratory took on this task and soon succeeded, and the experience gained in the work with liver was very useful. The enzymes remove the membrane quickly and easily, and the swimbladders become, in addition, much whiter and better in color in enzymatic processing than in customary processing. The quality is therefore better and more even. The output of processing also increases many times over. A lot is therefore gained by

enzymatic processing. One section of SIF has processed swimbladders exclusively since Easter and is doing well. In total, 3 tons have been processed. Another fish producer, the largest salt-fish producer in the country, is currently to start enzymatic processing of swimbladders. There should therefore be a sufficient supply of swimbladders for Catholics during next Lent.

The enzymatic processing of swimbladders is the first bioengineering process used in fish-processing. Hopefully their number will grow when time goes on.

It should be mentioned that the cod enzyme that the Icelandic Fisheries Laboratories and the Institute of Natural Sciences have isolated and studied in recent years turned out to be very suitable for the removal of membranes from both liver and swimbladders. The enzyme mixture has an excellent effect at a fairly low temperature, which is very advantageous. There seems to be a market for the enzyme, but it is not known how large this market is. Hopefully the day of enzyme production arrives soon. This is a good, broad-spectrum enzyme, which, because its origin, would be fit for use in seafood production.

4. Enzymatic stripping of skin in skate

A method to strip the skin of the starry ray using enzymes was developed in 1986 and 87. Food scientists Dr. Gudmundur Stefansson and Edda Magnusdottir carried out this work. They succeeded in developing a method that is quite suitable for skin stripping. However, no enzymatic processing of the starry ray has been carried out yet, but there is a market for it in Belgium, Britain, and France, where is is much-sought-after as food. Some starry ray is landed annually and enzymatic processing of the starry ray may begin when more thought is given to the utilization of discarded parts of catches. Work on the skate continued as what should be classed as information research only. An attempt was made to understand how enzymes break down skate skin. It would likely be possible to use the know-how

gained in this work in other comparable work, such as skinning of fish, scaling, shelling, and tenderizing of fish muscle. The results already show that some enzymes are more suitable than others for skinning and scaling, and this information is very valuable. A more reliable foundation is being laid for the bioengineering work of the laboratory.

5. Processing of shrimp roe

This work was started this fall. It is a joint project between the Icelandic Fisheries Laboratories, the Isafjordur Station of the Institute of Oceanic Research, and also the Isafjordur Station of the Laboratory.

Shrimps spawn in the fall. The shrimps then carry the roe with them all winter until the spring. They paste the roe to their back feet with a mucous material. It is difficult to process the roe because it does not tolerate fresh water. It is also delicate and breaks easily. The aim is to find a suitable way to process shrimp roe. There is reputedly a market for it in countries such as Japan. It is very delicious, a veritable gourmet food. Its color does not matter, although it is very peculiar.

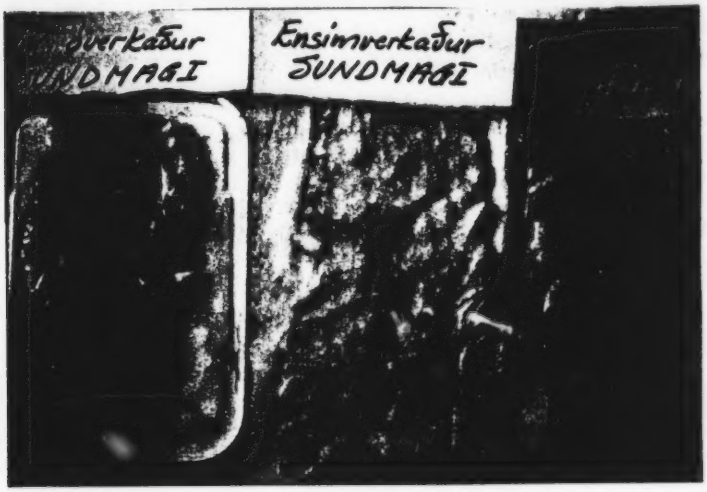
6. Conclusion

This has been an overall look at some issues. As was indicated in the beginning, no comprehensive picture of the bioengineering work of the Icelandic Fisheries Laboratories is given here. The work is too extensive and varied. However, it can be mentioned that bioengineering methods can solve various problems of fish processing, and the results can already be seen. In times of decreasing catches, it should be logical to consider better utilization of catches and look for the the greatest benefit. Biochemistry can offer real assistance in this respect.

The author is a bioengineer and employed by the Icelandic Fisheries Laboratories.

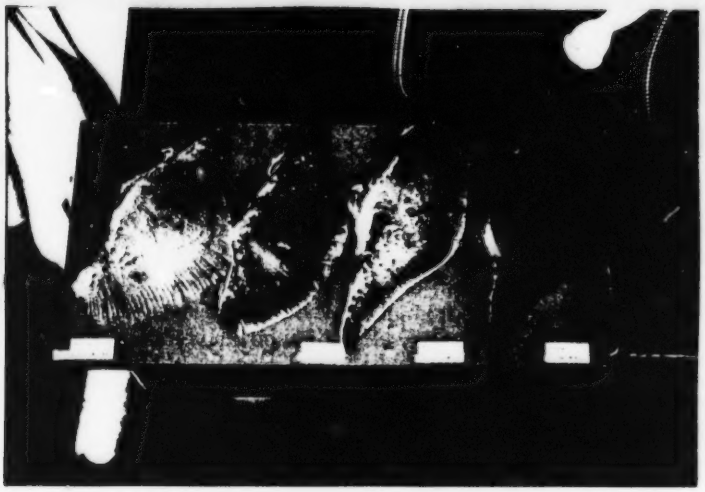
Frá tilraun til að losa himnu af þorsklifur.

Experiment to remove the membrane of cod liver.



Óverkaður sundmagi, ensímverkaður sundmagi, handverkaður sundmagi.

Unprocessed, enzymatically processed, and manually processed swimbladder.



Skata skrápflett með ensímum á mismunandi stigum.

Various stages of enzymatic stripping of skate skin.

Ýsa úr þorskmaga. Hér sést hvernig meltingarensím hafa unnið á ýsu.

Haddock from cod belly. It is seen how digestive enzymes have worked on the haddock.